--DYNAMIC ALLOCATION OF TRANSMISSION BANDWIDTH IN A COMMUNICATION SYSTEM--

IN THE ABSTRACT

Please delete the Abstract beginning on page 221, line 7 through page 222, line 8, and replace it with:

a5

--A head end is provided. The head end includes at least one modem for communicating with service units over a transmission bandwidth, the transmission bandwidth being divided into a number of subbands, each subband including a plurality of payload channels and at least one control channel and a control circuit, communicatively coupled with the at least one modem, that assigns each service unit to a subband such that the service units are substantially evenly distributed over the subbands.--

Remarks

Priority

In response to the Examiner's discussion of claim of priority, the specification has been modified to correspond to the claim of priority as found in the signed declaration/oath. A copy of the signed declaration/oath as filed is enclosed for the Examiner's convenience.

The Examiner objected to the declaration/oath and the Applicant does not find that a new declaration/oath is required. The declaration/oath as filed is correct and the cross-reference to related cases paragraph has been amended and corresponds to the signed declaration/oath as filed.

Rejection Under 35 U.S.C. § 102, First Paragraph

The Examiner rejected claims 2-12 under 35 U.S.C. § 102(e) as being clearly anticipated by Ortel, et al. (U.S. Patent No. 5,715,242). The Examiner also rejected

claims 2-12 under 35 U.S.C. § 102(e) as being clearly anticipated by Dubberly, et al. (5,719,872). Applicant respectfully traverses these rejections as the present application claims priority of an application with an earlier filing date than Ortel et al. The present Application is a divisional of U.S. Application Serial No. 08/673,002 filed 6/28/1996 that is a continuation-in-part of U.S. Application Serial No. 08/384,659 filed 2/6/1995. Ortel's earliest priority document was filed on 12/20/1995, which is over 9 months after the filing date of priority Application Serial No. 08/384,659 filed on 2/6/1995. Further Dubberly et al. was filed on 11/27/1996 over 19 months after the filing date of priority Application Serial No. 08/384,650 filed on 2/6/1995. Based on the foregoing, it is respectfully requested that the Examiner withdraw these rejections.

Claim 2 recites in part "a control circuit, communicatively coupled with the at least one modem, that assigns each service unit to a subband such that the service units are substantially evenly distributed over the subbands."

Dubberly et al. does not teach or suggest a control circuit that assigns each service unit to a subband such that the service units are substantially evenly distributed over the subbands as found in claim 2. As a result claim 2 should be allowed.

Claim 3 recites in part "a control circuit, communicatively coupled with the at least one modem, that assigns each service unit to a subband such that the load of the service units is substantially evenly distributed over the subbands."

Dubberly et al. does not teach or suggest a control circuit that assigns each service unit to a subband such that the load of the service units is substantially evenly distributed over the subbands as found in claim 3. As a result claim 3 should also be allowed.

Claim 4 depends from and further defines claim 3. Claim 4 recites in part "wherein the control circuit selectively assigns each service unit based on at least an expected load on a control channel in a subband." Dubberly et al. does not teach or suggest the limitation of claim 4. As such claim 4 should also be allowed.

Claim 5 depends from and further defines claim 3. Claim 5 recites in part "wherein the control circuit selectively assigns each service unit based on at least an

expected load for the service units." Dubberly et al. does not teach or suggest the limitation of claim 5. As such claim 5 should also be allowed.

Claim 6 depends from and further defines claim 3. Claim 6 recites in part "wherein the control circuit is further operable to allocate a payload channel to a service unit in response to a request for bandwidth for the service unit." Dubberly et al. does not teach or suggest the limitation of claim 6. As such claim 6 should also be allowed.

Claim 7 depends from and further defines claim 3. Claim 7 recites in part "wherein the control circuit is operable to assign a number of service units to each subband for selective use of the payload channels in the subband by the service units so as to increase the number of service units that can be coupled to a communication system." Dubberly et al. does not teach or suggest the limitation of claim 7. As such claim 7 should also be allowed.

Claim 8 is directed to a head end and recites in part "a control circuit, communicatively coupled with the at least one modem, that assigns each service unit to a subband such that the service units are substantially evenly distributed over the subbands, and wherein each subband includes a number of payload channels that transmit data at a first rate and a control channel that transmits data at a second rate, the second rate being slower than the first rate." Dubberly et al does not teach or suggest a control circuit that assigns each service unit to a subband such that the service units are substantially evenly distributed over the subbands as found in claim 8. Further Dubberly et al does not teach or suggest wherein each subband includes a number of payload channels that transmit data at a first rate and a control channel that transmits data at a second rate, the second rate being slower than the first rate as found in claim 8. As a result claim 8 should also be allowed.

Claim 9 depends from and further defines claim 8. Claim 9 recites in part "wherein the control circuit selectively assigns each service unit based on at least an expected load on a control channel in a subband." Dubberly et al. does not teach or suggest the limitation of claim 9. As such claim 9 should also be allowed.

Claim 10 depends from and further defines claim 8. Claim 10 recites in part "wherein the control circuit selectively assigns each service unit based on at least an expected load for the service units." Dubberly et al. does not teach or suggest the limitation of claim 10. As such claim 10 should also be allowed.

Claim 11 depends from and further defines claim 8. Claim 11 recites in part "wherein the control circuit is further operable to allocate a payload channel to a service unit in response to a request for bandwidth for the service unit." Dubberly et al. does not teach or suggest the limitation of claim 11. As such claim 11 should also be allowed.

Claim 12 depends from and further defines claim 8. Claim 12 recites in part "wherein the control circuit is operable to assign a number of service units to each subband for selective use of the payload channels in the subband by the service units so as to increase the number of service units that can be coupled to a communication system." Dubberly et al. does not teach or suggest the limitation of claim 12. As such claim 12 should also be allowed.

Conclusion

Applicant respectfully submits that the claims are in condition for allowance and notification to that effect is earnestly requested. If the Examiner has any questions or concerns regarding this application, please contact the undersigned at (612) 312-2205.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 501373.

Respectfully submitted,

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MARKED-UP VERSION OF AMENDMENTS

At pages 124-126, please replace the paragraphs beginning on page 124, line 29 and ending on page 126, line 18 with the following:

-- Referring to Figures 41, 42, and 43, the basic short integration operation is described. When a parity error 5000 of a channel is detected by the CXMU 56, a parity interrupt is disabled by setting the interrupt priority level above that of the parity interrupt 5001 (Figure 41). If a modem alarm is received which indicates a received signal failure, parity errors will be ignored until the failure condition ends 5002. Thus, some failure conditions will supersede parity error monitoring. Such alarm conditions may include loss of signal, modem failure, and loss of synchronization. If a modem alarm is not active 5004, a parity count table is updated 5006 and an error timer event as shown in Figure 42 is enabled 5008.

When the error timer event is enabled 5100, the channel monitor 296 enters a mode wherein parity error registers of the CXMU 56 are read every 10 milliseconds and error counts are summarized after a one second monitoring period 5105. Generally, the error counts are used to update the channel quality database 5334 and determine which (if any) channels require re-allocation. The channel quality table 300 of the database contains an ongoing record of each channel. The table organizes the history of the channels in categories such as: current ISU assigned to the channel, start of monitoring, end of monitoring, total error, errors in last day, in last week and in last 30 days, number of seconds since last error, severe errors in last day, in last week and in last 30 days, and current service type, such as ISDN, assigned to the channel.

As indicated in Figure 41, after the parity interrupt is disabled and no active alarm exists, the parity counts are updated 5006 and the timer event is enabled 5008. The timer event (Figure 42), as indicated above, includes a one second loop where the errors are monitored. As shown in Figure 42, if the one second loop has not elapsed 5110, the error counts are continued to be updated 5104. When

the second has elapsed 5106, the errors are summarized 5120. If the summarized errors over the one second period exceed an allowed amount indicating that an allocated channel is corrupted or bad 5121, as described below, channel allocator 304 is notified 5123 and ISU transmission is reallocated to a different channel. As shown in Figure 43, when the reallocation has been completed 5200, the interrupt priority is lowered below parity 5210 so that channel monitoring continues and the channel quality database is updated 5215 concerning the actions taken. The reallocation task may be accomplished as a separate task from the error timer task or performed in conjunction with that task. For example, the reallocator 304 may be part of channel monitor 296.

As shown in Figure 44 in an alternate embodiment of the error timer task 5110-2 of Figure 42, channels can be determined to be bad 5304 before the one second has elapsed. This allows the channels that are determined to be corrupted during the initial portion of a one second interval to be quickly identified and reallocated 5308 without waiting for the entire one second to elapse.

Instead of reallocation, the power level for transmission by the ISU may be increased to overcome the ingress on the channel. However, if the power level on one channel is increased, the power level of at least one other channel must be decreased as the overall power level must be kept substantially constant. If all channels are determined bad 5306, the fault isolator 302 is notified 5320 indicating the probability that a critical failure is present, such as a fiber break. If the summarized errors over the one second period do not exceed an allowed amount indicating that the allocated channel is not corrupted, the interrupt priority is lowered below parity 5210 and the error timer event is disabled 5332. Such event is then ended 5350 and the channels once again are monitored for parity errors per Figure 41.--

At page 129, please replace lines 8 – 18 with the following:

-- The following is a description of the long integration operation performed by the background monitor routine (Figure 45) of the channel monitor 296. The background monitor routine is used to ensure quality integrity for channels requiring greater quality than the short integration 10^{-3} bit error rate. As the flow diagram shows in Figure 45, the background monitor routine operates over a specified time for each service type, updates the channel quality database <u>6006</u> table 300, clears the background count <u>6008</u>, determines if the integrated errors exceed the allowable limits determined for each service type <u>6010</u>, and notifies the channel allocator 304 of bad channels as needed <u>6012</u>.

In operation, on one second intervals, the background monitor updates the channel quality database <u>6006</u> table. Updating the channel quality data table has two--

At pages 130-131, please replace the paragraphs beginning on page 130, line 20 – page 131, line 6 with the following:

--Unallocated or unused channels, but initialized and activated, whether used for reallocation for non-concentration services such as TR-8 or used for allocation or reallocation for concentration services such as TR-303, must also be monitored to insure that they are not bad, thereby reducing the chance that a bad channel will be allocated or reallocated to an ISU 100. To monitor unallocated channels, channel monitor 296 uses a backup manager routine (Figure 46) to set up unallocated channels in a loop in order to accumulate error data used to make allocation or re-allocation decisions. When an unallocated channel experiences errors <u>6110</u>, it will not be allocated to an ISU 100 for one hour <u>6118</u>. After the channel has remained idle (unallocated) for one hour, the channel monitor places the channel in a loop back mode <u>6120</u> to see if the channel has improved. In loop back mode, the CXMU 56 commands an initialized and activated ISU 100 to transmit a message on the channel long enough to perform short or long

integration on the parity errors as appropriate. In the loop back mode, it can be determined whether the previously corrupted channel has improved over time and the channel quality database is updated accordingly. When not in the loop back mode, such channels can be powered down. As described above, the channel quality database includes information to allow a reallocation or allocation to be made in such a manner that the channel used for allocation or reallocation is not corrupted. In addition, the information of the channel quality database can be utilized to rank the unallocated channels as for quality such that they can be allocated effectively. For example, a channel may be good enough for POTS and not good enough for ISDN. Another additional channel may be good enough for both. The additional channel may be held for ISDN transmission and not used for POTS. In addition, a particular standby channel of very good quality may be set aside such that when ingress is considerably high, one channel is always available to be switched to. --

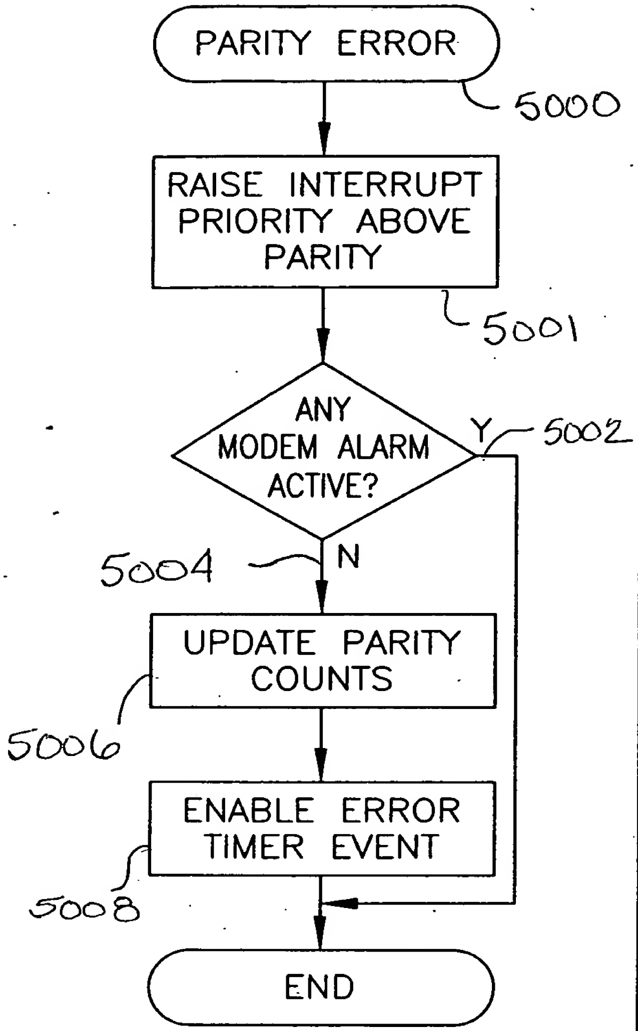


FIG. 41

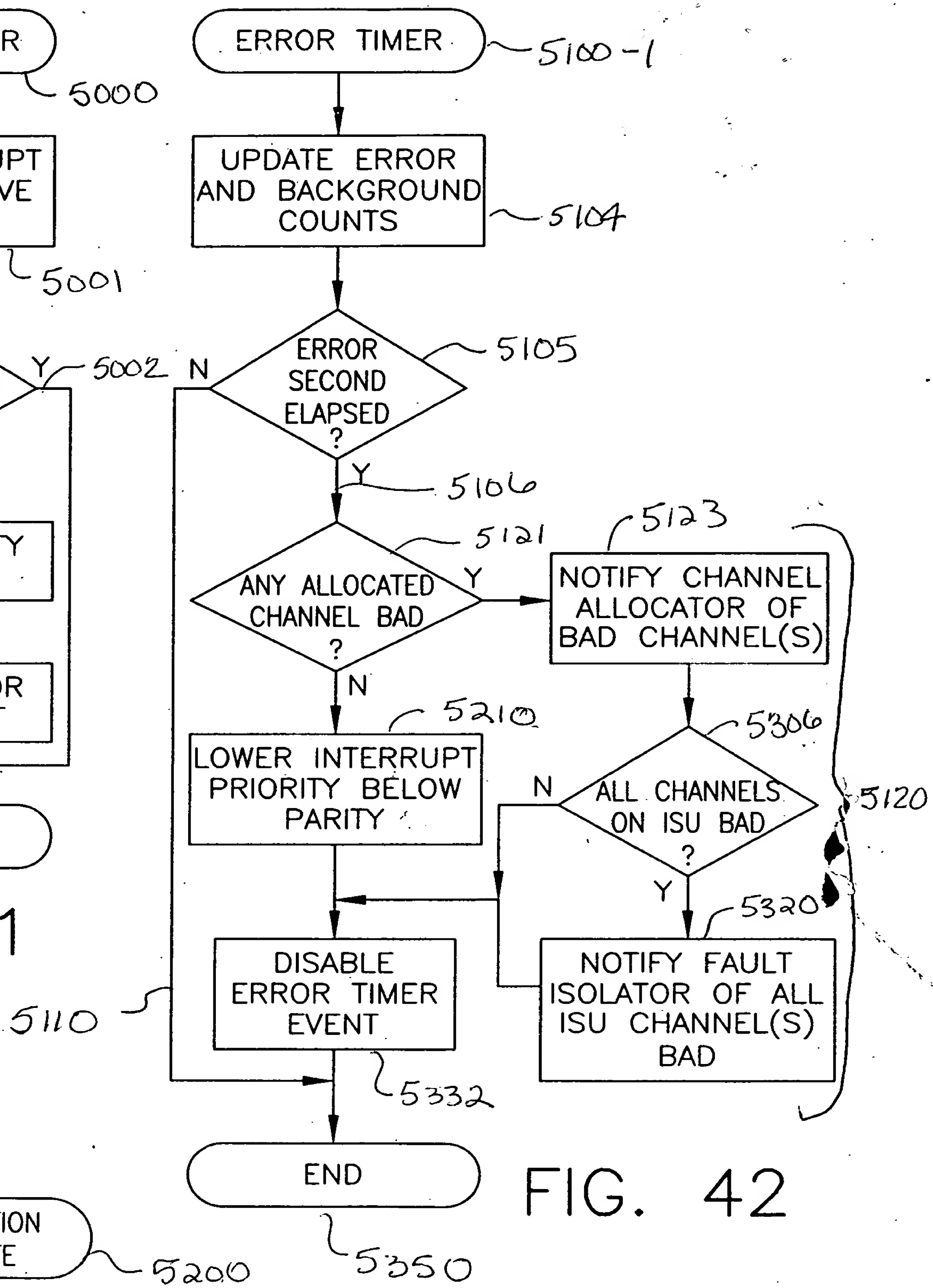


FIG. 42

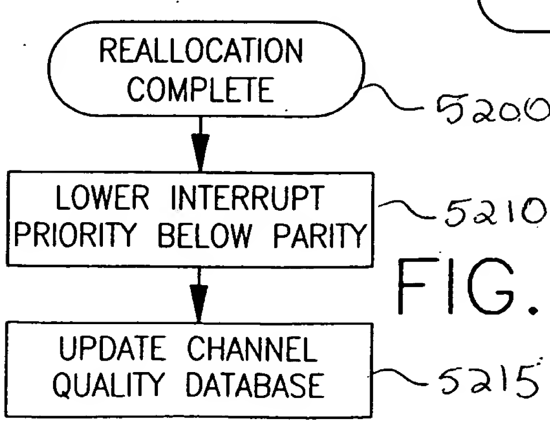


FIG. 43

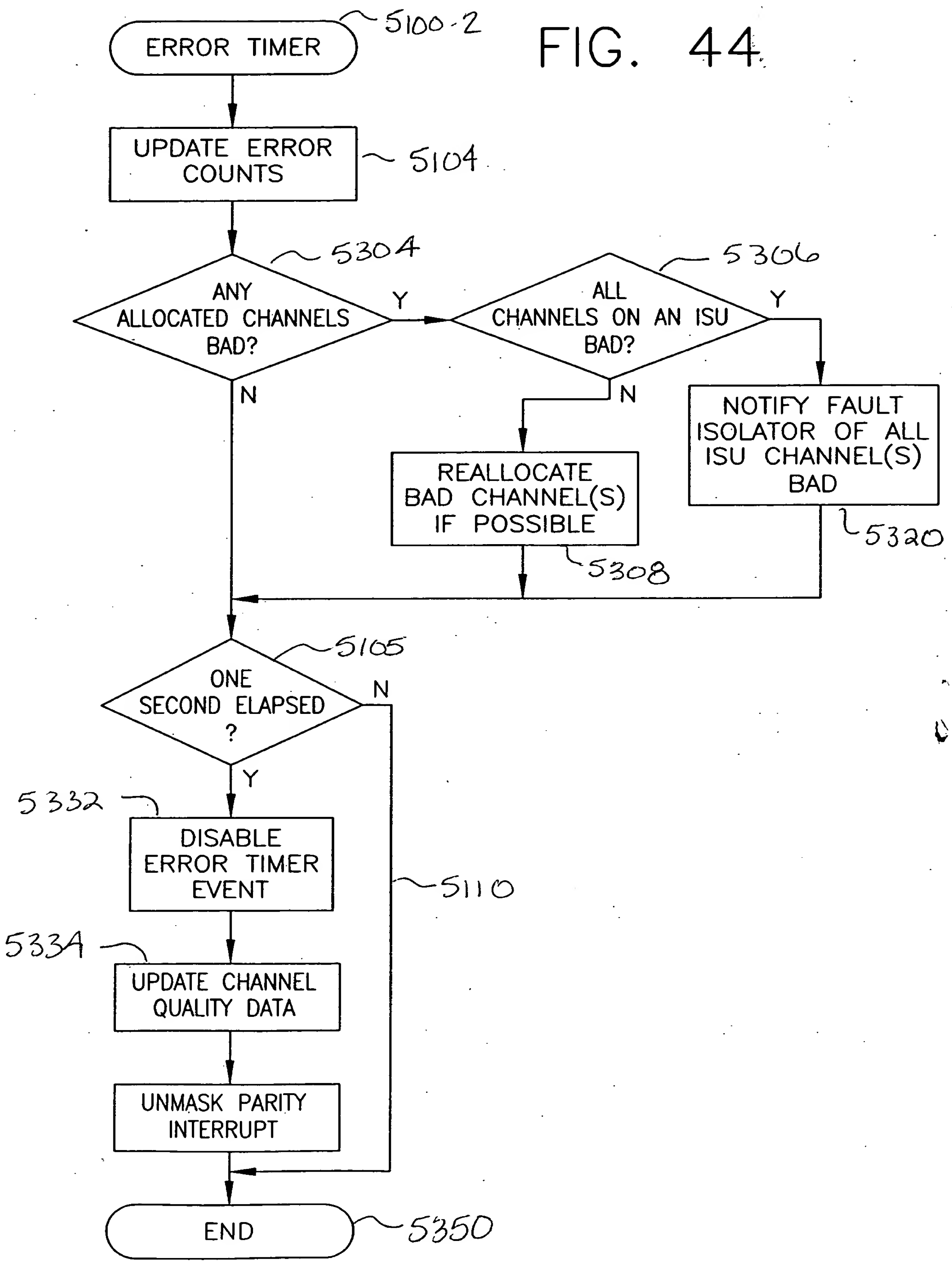

ERROR TIMER
5100-2
UPDATE ERROR COUNTS
5104
ANY ALLOCATED CHANNELS BAD?
5304
Y
N
ALL CHANNELS ON AN ISU BAD?
5306
Y
N
REALLOCATE BAD CHANNEL(S) IF POSSIBLE
5308
NOTIFY FAULT ISOLATOR OF ALL ISU CHANNEL(S) BAD
5320
ONE SECOND ELAPSED ?
5105
N
Y
5332
DISABLE ERROR TIMER EVENT
5110
5334
UPDATE CHANNEL QUALITY DATA
UNMASK PARITY INTERRUPT
END
5350

FIG. 44

FIG. 45

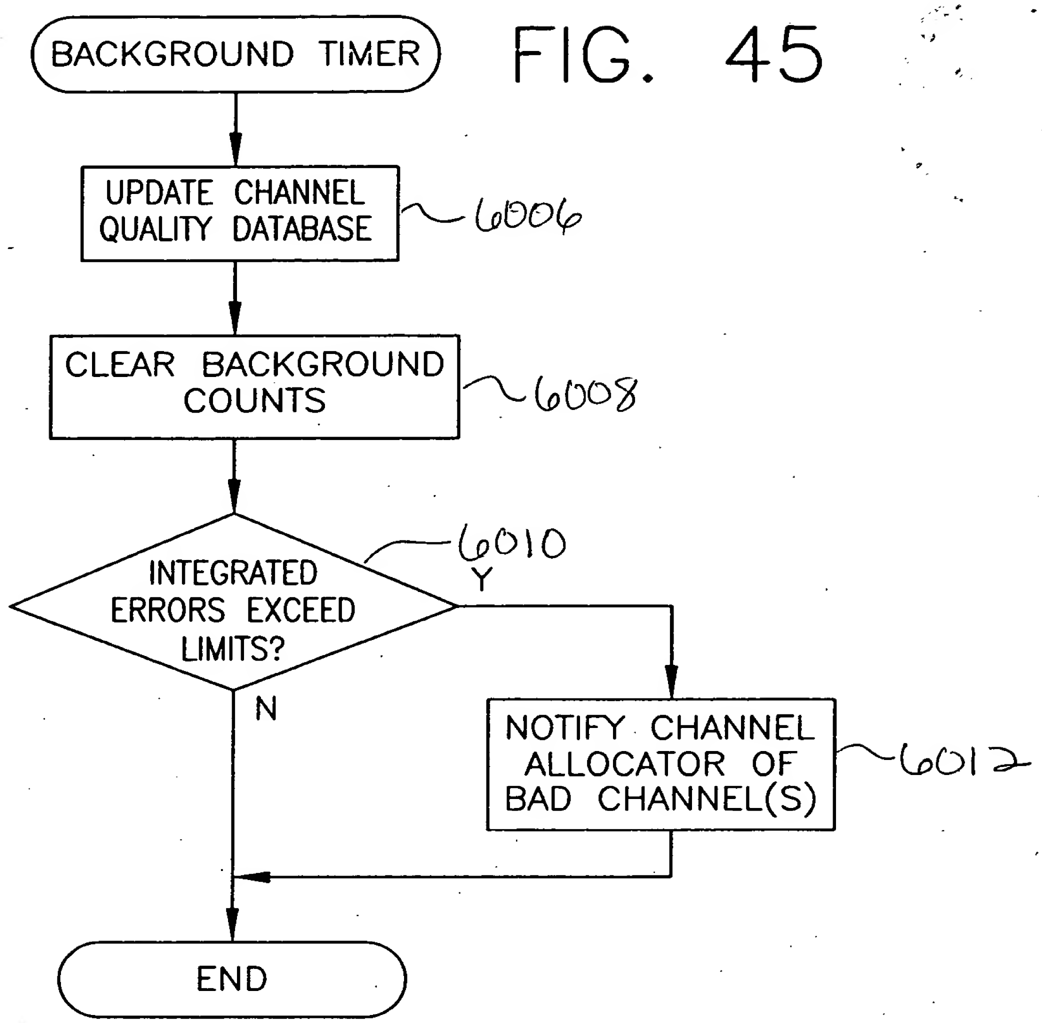
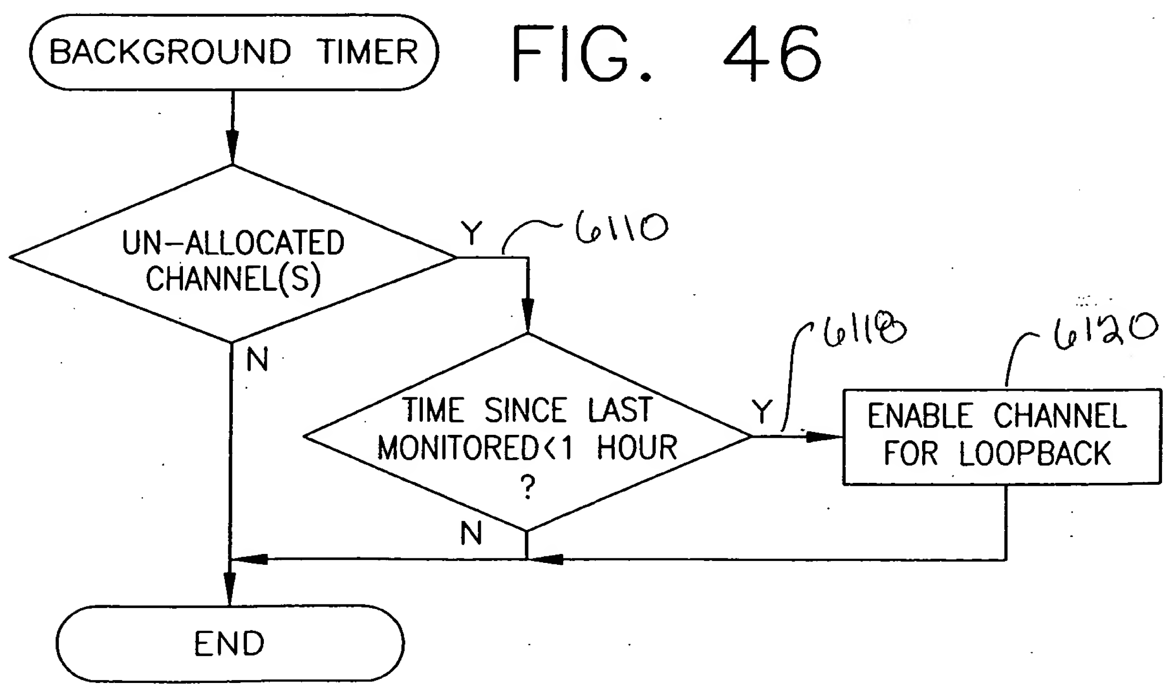

BACKGROUND TIMER
UPDATE CHANNEL QUALITY DATABASE
6006
CLEAR BACKGROUND COUNTS
6008
INTEGRATED ERRORS EXCEED LIMITS?
6010
Y
N
NOTIFY CHANNEL ALLOCATOR OF BAD CHANNEL(S)
6012
END

FIG. 46


BACKGROUND TIMER
UN-ALLOCATED CHANNEL(S)
Y
6110
N
TIME SINCE LAST MONITORED<1 HOUR ?
Y
6118
N
ENABLE CHANNEL FOR LOOPBACK
6120
END